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Klinkby, Esben Bryndt; Luis, Raul; Lopes, André ; Nonbøl, Erik

*Publication date:*  
2017

*Document Version*  
Peer reviewed version

[Link back to DTU Orbit](#)

*Citation (APA):*  
Klinkby, E. B., Luis, R., Lopes, A., & Nonbøl, E. (2017). *Neutronics analysis of the Collective Thomson Scattering diagnostic*. Abstract from XIIth ITER Neutronics Meeting, Caderache, France.

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## Neutronics analysis of the Collective Thomson Scattering diagnostic

Esben Klinkby, Center for Nuclear Technologies, Technical University of Denmark,

Raul Luis, Instituto Superior Técnico, Universidade de Lisboa

André Lopes, Instituto Superior Técnico, Universidade de Lisboa

Erik Nonbøl, Center for Nuclear Technologies, Technical University of Denmark,

The front-end components of the ITER Collective Thomson Scattering (CTS) diagnostics system will be installed inside the vacuum vessel directly exposed to the plasma. Therefore, these components will be subjected to high radiation doses from the plasma neutrons and from the gamma photons generated in nuclear interactions in the surrounding materials. These radiation doses will contribute to the thermal loads in the system and may cause irradiation-induced changes in the material properties, which can compromise the integrity of the components during the lifetime of ITER.

The nuclear heat loads were estimated using the Monte Carlo radiation transport code MCNP6. In order to perform the calculations, system-specific MCNP models of the CTS components were created and integrated in the reference C-Model, based on the most up-to-date CAD models of the CTS components. These CAD models were simplified and converted to the MCNP input format using ANSYS SpaceClaim and the CAD based modeling program MCAM. The changes made to the geometry of the reference MCNP model were limited to the minimum required. The materials and cross sections were taken from this reference model and standard MCNP tallies were added to perform the heat load calculations.

In addition to heat loads, neutron flux maps are also presented, to help identifying problematic regions in terms of neutron streaming and to provide an indicative measure of the contribution of the CTS system to the global shutdown dose rates in the port interspace. It is stressed, however, that the present modelling is to be regarded as local, as neighbouring diagnostics have not been modelled. Instead, bulk average materials consisting of  $B_4C$ , stainless steel and water are used as placeholders for neighbouring diagnostic systems.

The magnitudes of the nuclear heat loads and neutron fluxes obtained in the simulations peaks values at  $3 \text{ W/cm}^3$  in the receiver mirror, while in the launcher the heat load is  $1.5 \text{ W/cm}^3$ . The heat loads in the remaining components are below  $1 \text{ W/cm}^3$ . For components located at the back of the system, the heat loads are below  $10 \text{ mW/cm}^3$ .

The fluxes at the closure plate are of the order of  $10^8$  neutrons/cm<sup>2</sup>/s for energies between 0 and 1 MeV, and approximately one order of magnitude lower in the 1-20 MeV energy range. It is estimated that with such neutron fluxes the shutdown dose rates may exceed  $100 \text{ } \mu\text{Sv/h}$  in the closure plate, taking only into account the contribution from the CTS system in drawer 3 of equatorial port plug #12.